

A36.9.6 FLIGHT PATH DISTANCES—Continued

Distance	Unit	Meaning
OP	Feet (meters)	Approach flight track distance. The distance from the runway threshold to the approach flight track position along the extended center line of the runway after which the position of the airplane need no longer be recorded.

[Amdt. 36-54, 67 FR 45212, July 8, 2002; Amdt. 36-24, 67 FR 63195, 63196, Oct. 10, 2002; 68 FR 1512, Jan 10, 2003; Amdt. 36-26, 70 FR 38749, July 5, 2005]

APPENDIX B TO PART 36—NOISE LEVELS FOR TRANSPORT CATEGORY AND JET AIRPLANES UNDER § 36.103

Sec.

B36.1 *Noise Measurement and Evaluation.*B36.2 *Noise Evaluation Metric.*B36.3 *Reference Noise Measurement Points.*B36.4 *Test Noise Measurement Points.*B36.5 *Maximum Noise Levels.*B36.6 *Trade-Offs.*B36.7 *Noise Certification Reference Procedures and Conditions.*B36.8 *Noise Certification Test Procedures.**Section B36.1 Noise measurement and evaluation*

(a) The procedures of Appendix A of this part, or approved equivalent procedures, must be used to determine noise levels of an airplane. These noise levels must be used to show compliance with the requirements of this appendix.

(b) For Stage 4 airplanes, an acceptable alternative for noise measurement and evaluation is Appendix 2 to the International Civil Aviation Organization (ICAO) Annex 16, Environmental Protection, Volume I, Aircraft Noise, Third Edition, July 1993, Amendment 7, effective March 21, 2002. [Incorporated by reference, see § 36.6].

Section B36.2 Noise Evaluation Metric

The noise evaluation metric is the effective perceived noise level expressed in EPNdB, as calculated using the procedures of appendix A of this part.

Section B36.3 Reference Noise Measurement Points

When tested using the procedures of this part, except as provided in section B36.6, an airplane may not exceed the noise levels specified in section B36.5 at the following points on level terrain:

(a) Lateral full-power reference noise measurement point:

(1) For jet airplanes: The point on a line parallel to and 1,476 feet (450 m) from the

runway centerline, or extended centerline, where the noise level after lift-off is at a maximum during takeoff. For the purpose of showing compliance with Stage 1 or Stage 2 noise limits for an airplane powered by more than three jet engines, the distance from the runway centerline must be 0.35 nautical miles (648 m). For jet airplanes, when approved by the FAA, the maximum lateral noise at takeoff thrust may be assumed to occur at the point (or its approved equivalent) along the extended centerline of the runway where the airplane reaches 985 feet (300 meters) altitude above ground level. A height of 1427 feet (435 meters) may be assumed for Stage 1 or Stage 2 four engine airplanes. The altitude of the airplane as it passes the noise measurement points must be within +328 to -164 feet (+100 to -50 meters) of the target altitude. For airplanes powered by other than jet engines, the altitude for maximum lateral noise must be determined experimentally.

(2) For propeller-driven airplanes: The point on the extended centerline of the runway above which the airplane, at full takeoff power, reaches a height of 2,133 feet (650 meters). For tests conducted before August 7, 2002, an applicant may use the measurement point specified in section B36.3(a)(1) as an alternative.

(b) Flyover reference noise measurement point: The point on the extended centerline of the runway that is 21,325 feet (6,500 m) from the start of the takeoff roll;

(c) Approach reference noise measurement point: The point on the extended centerline of the runway that is 6,562 feet (2,000 m) from the runway threshold. On level ground, this corresponds to a position that is 394 feet (120 m) vertically below the 3° descent path, which originates at a point on the runway 984 feet (300 m) beyond the threshold.

Section B36.4 Test noise measurement points.

(a) If the test noise measurement points are not located at the reference noise measurement points, any corrections for the difference in position are to be made using the same adjustment procedures as for the differences between test and reference flight paths.

(b) The applicant must use a sufficient number of lateral test noise measurement points to demonstrate to the FAA that the maximum noise level on the appropriate lateral line has been determined. For jet airplanes, simultaneous measurements must be made at one test noise measurement point at its symmetrical point on the other side of the runway. Propeller-driven airplanes have an inherent asymmetry in lateral noise. Therefore, simultaneous measurements must be made at each and every test noise measurement point at its symmetrical position on the opposite side of the runway. The measurement points are considered to be

symmetrical if they are longitudinally within 33 feet (± 10 meters) of each other.

Section B36.5 Maximum Noise Levels

Except as provided in section B36.6 of this appendix, maximum noise levels, when determined in accordance with the noise evaluation methods of appendix A of this part, may not exceed the following:

(a) For acoustical changes to Stage 1 airplanes, regardless of the number of engines, the noise levels prescribed under §36.7(c) of this part.

(b) For any Stage 2 airplane regardless of the number of engines:

(1) Flyover: 108 EPNdB for maximum weight of 600,000 pounds or more; for each halving of maximum weight (from 600,000 pounds), reduce the limit by 5 EPNdB; the limit is 93 EPNdB for a maximum weight of 75,000 pounds or less.

(2) Lateral and approach: 108 EPNdB for maximum weight of 600,000 pounds or more; for each halving of maximum weight (from 600,000 pounds), reduce the limit by 2 EPNdB; the limit is 102 EPNdB for a maximum weight of 75,000 pounds or less.

(c) For any Stage 3 airplane:

(1) Flyover.

(i) For airplanes with more than 3 engines: 106 EPNdB for maximum weight of 850,000 pounds or more; for each halving of maximum weight (from 850,000 pounds), reduce the limit by 4 EPNdB; the limit is 89 EPNdB for a maximum weight of 44,673 pounds or less;

(ii) For airplanes with 3 engines: 104 EPNdB for maximum weight of 850,000 pounds or more; for each halving of maximum weight (from 850,000 pounds), reduce the limit by 4 EPNdB; the limit is 89 EPNdB for a maximum weight of 63,177 pounds or less; and

(iii) For airplanes with fewer than 3 engines: 101 EPNdB for maximum weight of 850,000 pounds or more; for each halving of maximum weight (from 850,000 pounds), reduce the limit by 4 EPNdB; the limit is 89 EPNdB for a maximum weight of 106,250 pounds or less.

(2) Lateral, regardless of the number of engines: 103 EPNdB for maximum weight of 882,000 pounds or more; for each halving of maximum weight (from 882,000 pounds), reduce the limit by 2.56 EPNdB; the limit is 94 EPNdB for a maximum weight of 77,200 pounds or less.

(3) Approach, regardless of the number of engines: 105 EPNdB for maximum weight of 617,300 pounds or more; for each halving of maximum weight (from 617,300 pounds), reduce the limit by 2.33 EPNdB; the limit is 98 EPNdB for a maximum weight of 77,200 pounds or less.

(d) For any Stage 4 airplane, the flyover, lateral, and approach maximum noise levels are prescribed in Chapter 4, Paragraph 4.4,

Maximum Noise Levels, and Chapter 3, Paragraph 3.4, Maximum Noise Levels, of the International Civil Aviation Organization (ICAO) Annex 16, Environmental Protection, Volume I, Aircraft Noise, Third Edition, July 1993, Amendment 7, effective March 21, 2002. [Incorporated by reference, see §36.6].

Section B36.6 Trade-Offs

Except when prohibited by sections 36.7(c)(1) and 36.7(d)(1)(ii), if the maximum noise levels are exceeded at any one or two measurement points, the following conditions must be met:

(a) The sum of the exceedance(s) may not be greater than 3 EPNdB;

(b) Any exceedance at any single point may not be greater than 2 EPNdB, and

(c) Any exceedance(s) must be offset by a corresponding amount at another point or points.

Section B36.7 Noise Certification Reference Procedures and Conditions

(a) General conditions:

(1) All reference procedures must meet the requirements of section 36.3 of this part.

(2) Calculations of airplane performance and flight path must be made using the reference procedures and must be approved by the FAA.

(3) Applicants must use the takeoff and approach reference procedures prescribed in paragraphs (b) and (c) of this section.

(4) [Reserved]

(5) The reference procedures must be determined for the following reference conditions. The reference atmosphere is homogeneous in terms of temperature and relative humidity when used for the calculation of atmospheric absorption coefficients.

(i) Sea level atmospheric pressure of 2116 pounds per square foot (psf) (1013.25 hPa);

(ii) Ambient sea-level air temperature of 77 °F (25 °C, *i.e.*, ISA+10 °C);

(iii) Relative humidity of 70 per cent;

(iv) Zero wind.

(v) In defining the reference takeoff flight path(s) for the takeoff and lateral noise measurements, the runway gradient is zero.

(b) Takeoff reference procedure:

The takeoff reference flight path is to be calculated using the following:

(1) Average engine takeoff thrust or power must be used from the start of takeoff to the point where at least the following height above runway level is reached. The takeoff thrust/power used must be the maximum available for normal operations given in the performance section of the airplane flight manual under the reference atmospheric conditions given in section B36.7(a)(5).

(i) For Stage 1 airplanes and for Stage 2 airplanes that do not have jet engines with a bypass ratio of 2 or more, the following apply:

(A): For airplanes with more than three jet engines—700 feet (214 meters).

(B): For all other airplanes—1,000 feet (305 meters).

(ii) For Stage 2 airplanes that have jet engines with a bypass ratio of 2 or more and for Stage 3 airplanes, the following apply:

(A): For airplanes with more than three engines—689 feet (210 meters).

(B): For airplanes with three engines—853 feet (260 meters).

(C): For airplanes with fewer than three engines—984 feet (300 meters).

(2) Upon reaching the height specified in paragraph (b)(1) of this section, airplane thrust or power must not be reduced below that required to maintain either of the following, whichever is greater:

(i) A climb gradient of 4 per cent; or

(ii) In the case of multi-engine airplanes, level flight with one engine inoperative.

(3) For the purpose of determining the lateral noise level, the reference flight path must be calculated using full takeoff power throughout the test run without a reduction in thrust or power. For tests conducted before August 7, 2002, a single reference flight path that includes thrust cutback in accordance with paragraph (b)(2) of this section, is an acceptable alternative in determining the lateral noise level.

(4) The takeoff reference speed is the all-engine operating takeoff climb speed selected by the applicant for use in normal operation; this speed must be at least $V_2+10\text{kt}$ ($V_2+19\text{km/h}$) but may not be greater than $V_2+20\text{kt}$ ($V_2+37\text{km/h}$). This speed must be attained as soon as practicable after lift-off and be maintained throughout the takeoff noise certification test. For Concorde airplanes, the test day speeds and the acoustic day reference speed are the minimum approved value of V_2+35 knots, or the all-engines-operating speed at 35 feet, whichever speed is greater as determined under the regulations constituting the type certification basis of the airplane; this reference speed may not exceed 250 knots. For all airplanes, noise values measured at the test day speeds must be corrected to the acoustic day reference speed.

(5) The takeoff configuration selected by the applicant must be maintained constantly throughout the takeoff reference procedure, except that the landing gear may be retracted. Configuration means the center of gravity position, and the status of the airplane systems that can affect airplane performance or noise. Examples include, the position of lift augmentation devices, whether the APU is operating, and whether air bleeds and engine power take-offs are operating;

(6) The weight of the airplane at the brake release must be the maximum takeoff weight at which the noise certification is requested, which may result in an operating limitation as specified in §36.1581(d); and

(7) The average engine is defined as the average of all the certification compliant engines used during the airplane flight tests, up to and during certification, when operating within the limitations and according to the procedures given in the Flight Manual. This will determine the relationship of thrust/power to control parameters (e.g., N_1 or EPR). Noise measurements made during certification tests must be corrected using this relationship.

(c) Approach reference procedure:

The approach reference flight path must be calculated using the following:

(1) The airplane is stabilized and following a 3° glide path;

(2) For subsonic airplanes, a steady approach speed of $V_{\text{ref}} + 10$ kts ($V_{\text{ref}} + 19$ km/h) with thrust and power stabilized must be established and maintained over the approach measuring point. V_{ref} is the reference landing speed, which is defined as the speed of the airplane, in a specified landing configuration, at the point where it descends through the landing screen height in the determination of the landing distance for manual landings. For Concorde airplanes, a steady approach speed that is either the landing reference speed + 10 knots or the speed used in establishing the approved landing distance under the airworthiness regulations constituting the type certification basis of the airplane, whichever speed is greater. This speed must be established and maintained over the approach measuring point.

(3) The constant approach configuration used in the airworthiness certification tests, but with the landing gear down, must be maintained throughout the approach reference procedure;

(4) The weight of the airplane at touch-down must be the maximum landing weight permitted in the approach configuration defined in paragraph (c)(3) of this section at which noise certification is requested, except as provided in §36.1581(d) of this part; and

(5) The most critical configuration must be used; this configuration is defined as that which produces the highest noise level with normal deployment of aerodynamic control surfaces including lift and drag producing devices, at the weight at which certification is requested. This configuration includes all those items listed in section A36.5.2.5 of appendix A of this part that contribute to the noisiest continuous state at the maximum landing weight in normal operation.

Section B36.8 Noise Certification Test Procedures

(a) All test procedures must be approved by the FAA.

(b) The test procedures and noise measurements must be conducted and processed in an approved manner to yield the noise evaluation metric EPNL, in units of EPNdB, as described in appendix A of this part.

(c) Acoustic data must be adjusted to the reference conditions specified in this appendix using the methods described in appendix A of this part. Adjustments for speed and thrust must be made as described in section A36.9 of this part.

(d) If the airplane's weight during the test is different from the weight at which noise certification is requested, the required EPNL adjustment may not exceed 2 EPNdB for each takeoff and 1 EPNdB for each approach. Data approved by the FAA must be used to determine the variation of EPNL with weight for both takeoff and approach test conditions. The necessary EPNL adjustment for variations in approach flight path from the reference flight path must not exceed 2 EPNdB.

(e) For approach, a steady glide path angle of $3^{\circ} \pm 0.5^{\circ}$ is acceptable.

(f) If equivalent test procedures different from the reference procedures are used, the test procedures and all methods for adjusting the results to the reference procedures must be approved by the FAA. The adjustments may not exceed 16 EPNdB on takeoff and 8 EPNdB on approach. If the adjustment is more than 8 EPNdB on takeoff, or more than 4 EPNdB on approach, the resulting numbers must be more than 2 EPNdB below the limit noise levels specified in section B36.5.

(g) During takeoff, lateral, and approach tests, the airplane variation in instantaneous indicated airspeed must be maintained within $\pm 3\%$ of the average airspeed between the 10 dB-down points. This airspeed is determined by the pilot's airspeed indicator. However, if the instantaneous indicated airspeed exceeds ± 3 kt (± 5.5 km/h) of the average airspeed over the 10 dB-down points, and is determined by the FAA representative on the flight deck to be due to atmospheric turbulence, then the flight so affected must be rejected for noise certification purposes.

NOTE: Guidance material on the use of equivalent procedures is provided in the current advisory circular for this part.

[Amdt. 36-54, 67 FR 45235, July 8, 2002; Amdt. 36-24, 67 FR 63196, Oct. 10, 2002; 68 FR 1512, Jan. 10, 2003; Amdt. 36-26, 70 FR 38749, July 5, 2005]

APPENDIXES C-E TO PART 36 [RESERVED]

APPENDIX F TO PART 36—FLYOVER NOISE REQUIREMENTS FOR PROPELLER-DRIVEN SMALL AIRPLANE AND PROPELLER-DRIVEN, COMMUTER CATEGORY AIRPLANE CERTIFICATION TESTS PRIOR TO DECEMBER 22, 1988

PART A—GENERAL

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F36.1 *Scope.*

PART B—NOISE MEASUREMENT

- F36.101 *General test conditions.*
- F36.103 *Acoustical measurement system.*
- F36.105 *Sensing, recording, and reproducing equipment.*
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PART C—DATA CORRECTION

- F36.201 *Correction of data.*
- F36.203 *Validity of results.*

PART D—NOISE LIMITS

- F36.301 *Aircraft noise limits.*

PART A—GENERAL

Section F36.1 Scope. This appendix prescribes noise level limits and procedures for measuring and correcting noise data for the propeller driven small airplanes specified in §§36.1 and 36.501(b).

PART B—NOISE MEASUREMENT

Sec. F36.101 General test conditions.

(a) The test area must be relatively flat terrain having no excessive sound absorption characteristics such as those caused by thick, matted, or tall grass, by shrubs, or by wooded areas. No obstructions which significantly influence the sound field from the airplane may exist within a conical space above the measurement position, the cone being defined by an axis normal to the ground and by a half-angle 75 degrees from this axis.

(b) The tests must be carried out under the following conditions:

- (1) There may be no precipitation.
- (2) Relative humidity may not be higher than 90 percent or lower than 30 percent.
- (3) Ambient temperature may not be above 86 degrees F. or below 41 degrees F. at 33' above ground. If the measurement site is within 1 n.m. of an airport thermometer the airport reported temperature may be used.
- (4) Reported wind may not be above 10 knots at 33' above ground. If wind velocities of more than 4 knots are reported, the flight direction must be aligned to within ± 15 degrees of wind direction and flights with tail wind and head wind must be made in equal numbers. If the measurement site is within 1 n.m. of an airport anemometer, the airport reported wind may be used.

(5) There may be no temperature inversion or anomalous wind conditions that would significantly alter the noise level of the airplane when the noise is recorded at the required measuring point.

(6) The flight test procedures, measuring equipment, and noise measurement procedures must be approved by the FAA.

(7) Sound pressure level data for noise evaluation purposes must be obtained with